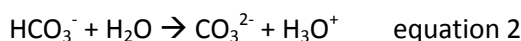
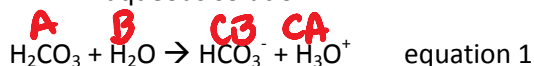


1. According to the Lewis definition, an acid is:

- A. a proton donor
- B. an electron pair donor
- C. an electron acceptor
- D. an electron pair acceptor**

2. Consider the dissociation of carbonic acid in aqueous solution:



Which of the following is correct?

- A. HCO_3^- acts as an acid in equation 1 but as a base in equation 2
- B. HCO_3^- is the conjugate base of H_2O
- C. HCO_3^- is the conjugate acid of CO_3^{2-}**
- D. H_2CO_3 and CO_3^{2-} are a conjugate acid-base pair

3. The pH of a solution of $0.0100 \text{ mol dm}^{-3}$ hydrochloric acid is 2; 10 cm^3 of the acid is measured out and distilled water added to dilute it to a total volume of 100 cm^3 . How do the hydrogen ion concentration and the pH change as this solution is distilled?

$(0.01)(10) = (x)(100) \quad x = 0.001$

Hydrogen ion concentration pH

- A. decreases by a factor of 10 increases by 1**
- B. decreases by a factor of 100 decreases by 2
- C. increases by a factor of 10 increases by 1
- D. decreases by a factor of 10 decreases by 1

4. The electrical conductivity of five aqueous solutions is measured:

- I. $0.100 \text{ mol dm}^{-3} \text{ NaOH(aq)}$ **SB**
- II. $0.100 \text{ mol dm}^{-3} \text{ CH}_3\text{COOH(aq)}$ **WA**
- III. $0.100 \text{ mol dm}^{-3} \text{ NH}_4\text{Cl(aq)}$ **salt**
- IV. $0.100 \text{ mol dm}^{-3} \text{ NH}_3(\text{aq})$ **WB**
- V. $0.100 \text{ mol dm}^{-3} \text{ HCl(aq)}$ **SA**

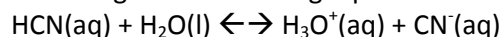
Which of the following is correct?

- A. The conductivity of I is higher than that of II but lower than that of IV. **F**
- B. The conductivity of III is higher than that of II and higher than that of IV. **T****

C. The conductivity of V is lower than that of II but higher than that of III. **F**

D. The conductivity of I is lower than that of III and lower than that of IV. **F**

5. HCN is a weak acid and dissociates in water according to the following equilibrium:



Which of the following statements is correct?

- A. HCN dissociates completely in solution.
- B. The concentration of CN^- ions is greater than that of HCN.
- C. CN^- is a stronger base than H_2O .**
- D. H_3O^+ acts as a Brønsted-Lowry base.

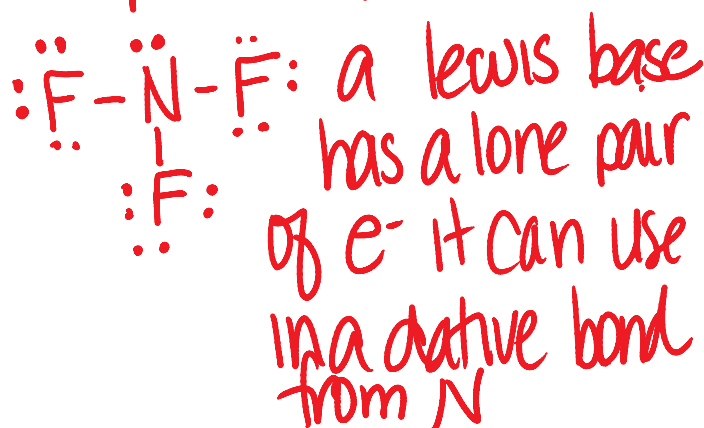
6. Describe two different methods, one chemical and one physical, other than measuring the pH, that could be used to distinguish between ethanoic acid and hydrochloric acid solutions of the same concentration. (Total 4 marks)

Chemical -
 reactivity w/ metal - HCl will react faster, ethanoic slower

Physical
 conductivity - HCl more conductive, ethanoic less

7. Define an acid in terms of the Lewis theory. Deduce, giving a reason, whether NF_3 is able to function as a Lewis acid or as a Lewis base. (Total 2 marks)

- An acid is an electron pair acceptor



8. (a) The nitrite ion is present in nitrous acid, HNO_2 , which is a weak acid. The nitrate ion is present in nitric acid, HNO_3 , which is a strong acid. Distinguish between the terms strong and weak acid and state the equations used to show the dissociation of each acid in aqueous solution. (3)



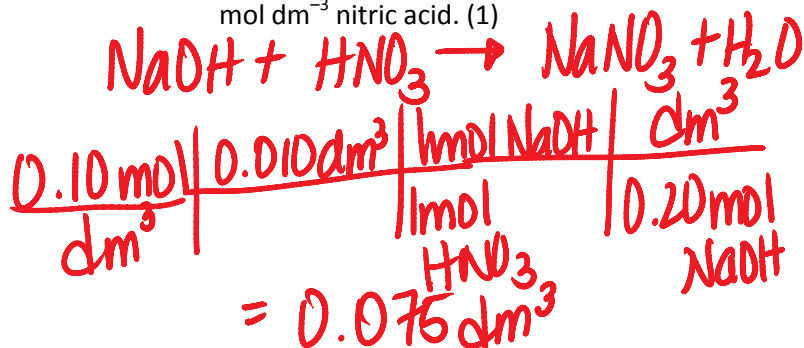
Strong means complete dissociation of acid, weak means partial dissociation

- (b) A small piece of magnesium ribbon is added to solutions of nitric and nitrous acid of the same concentration at the same temperature. Describe two observations that would allow you to distinguish between the two acids. (2)

- HNO_3 will react faster than HNO_2
- Mg will dissolve faster in HNO_3

- (c) A student decided to investigate the reactions of the two acids with separate samples of 0.20 mol dm^{-3} sodium hydroxide solution.

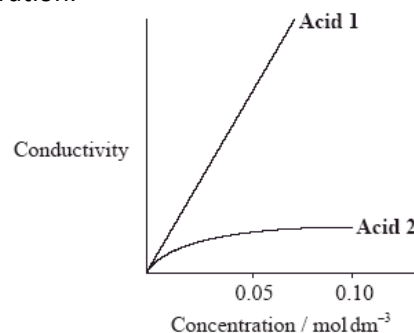
- (i) Calculate the volume of the sodium hydroxide solution required to react exactly with a 15.0 cm^3 solution of 0.10 mol dm^{-3} nitric acid. (1)



- (ii) The following hypothesis was suggested by the student: "Since nitrous acid is a weak acid it will react with a smaller volume of the 0.20 mol dm^{-3} sodium hydroxide solution." Comment on whether or not this is a valid hypothesis. (1)

Invalid conc. is the same so it would require the same amt NaOH - strength is not the same as concentration

- (d) The graph below shows how the conductivity of the two acids changes with concentration.



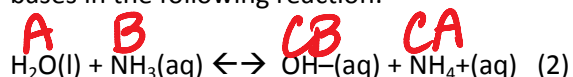
- Identify Acid 1 and explain your choice. (2)

HNO_3 - strong acids have higher conductivity due to more ions in solution

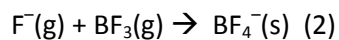
9. (a) Define a Brønsted-Lowry acid. (1)

donates a proton (H^+)

- (b) Deduce the two acids and their conjugate bases in the following reaction:



(c) Explain why the following reaction can also be described as an acid-base reaction.



(Total 5 marks)

Lewis acid/base reaction
 BF_3 is Lewis acid
 F^- Lewis base
so an e^- pair is
being transferred